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BALLY MANUFACTURING CORPORATION, a Delaware corporation,

Plaintiff/Counterdefendant,

vs.

D. GOTTLIEB & CO., a corporation, WILLIAMS ELECTRONICS, INC., a corporation, and ROCKWELL INTERNATIONAL CORPORATION,

Defendants/Counterplaintiffs.

) Docket No.
) 78 C 2246
)
) Chicago, Illinois
) January 4, 1984
) 9:30 a.m.

VOLUME II-A
TRANSCRIPT OF PROCEEDINGS
BEFORE THE HONORABLE JOHN F. GRADY

TRANSCRIPT ORDERED BY: MR. JEROLD B. SCHNAYER
MR. MELVIN M. GOLDENBERG

APPEARANCES:

For the Plaintiff/Counterdefendant:
MR. KATZ
MR. SCHNAYER

MR. TONE
MS. SIGEL

For the Defendants/Counterplaintiffs:
MR. LYNCH
MR. HARDING
MR. GOLDENBERG
MR. ELLIOTT
MR. RIFKIN
MR. ARVEY

Court Reporter: LAURA M. BRENNAN
219 South Dearborn Street, Room 1918
Chicago, Illinois 60604

THE COURT: Good morning.

MR. LYNCH: Good morning, Judge.

(Brief interruption.)

MR. TONE: I apologize, your Honor. I had understood 9:45, and so I was oblivious to the --

THE COURT: No problem.

MR. TONE: May I make one inquiry?

THE COURT: Yes.

MR. TONE: Your Honor said we would not be working Wednesday afternoons, and on the basis of that, I set a meeting here with some lawyers who were coming in from various parts of the country for a meeting on Wednesday afternoon the 11th, and I wanted to make sure I was safe in doing that.

THE COURT: You are. Every Wednesday afternoon I have my motion call, so we will never meet on Wednesday afternoons.

I would like, in fact, not to meet on Wednesday mornings because that is a time that I can get other work done in chambers, but I am tentatively thinking of meeting on Wednesday mornings at least initially because there are going to be so many other interruptions that will be unavoidable; but Wednesday afternoon you always have free.

MR. TONE: Very good. Thank you.

Mr. Frederiksen, will you resume the stand?

JEFFREY E. FREDERIKSEN, PLAINTIFF'S WITNESS, RESUMED.

THE COURT: Good morning.

THE WITNESS: Good morning, your Honor.

THE COURT: Please be seated.

DIRECT EXAMINATION (Continued)

BY MR. TONE:

Q. Mr. Frederiksen, you are still under oath, and we will resume the examination where we left off yesterday.

We were talking about the matter of dealing with noise on the input side. Do you recall that?

A. Yes.

Q. Before going on to the next phase of that general subject of noise, I would like you to explain, if you would, the difference between strobing the columns and strobing the rows, and I think you can perhaps do that down on this drawing we made yesterday, referring now to Plaintiff's Exhibit 384.

A. We are dealing with time division multiplexing, which means we are going to share a resource, and the resource we are sharing, for example, in conjunction with the lamps is these four lamp wires. At any one time we can only power up four lamps.

The way that you power up those four lamps is to apply power to, for example, column 1 first and then to column 2 and column 3 and column 4 in sequence, but while you are applying that power to column 1, that term is referred to as strobing column 1 since it is only there for a brief period of time.

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Q All right. And what about the rows, what do you do with the rows?

A. Well, at the time that you're strobing column 1, you apply the proper data to the row. In other words, you have to put the proper lamps on for that column that you wish.

Q And how long is a strobe on a column? I think you -- maybe you didn't say yesterday.

A. It would be something in the area of around a hundred-cycle rate, and that should be about, on 16 mux lines, it would be just about a millisecond, not much longer than that.

Q Is that one ten-thousandth of a second?

A. That's about a thousandth of a second per line, a little over a thousandth of a second -- a little less than a thousandth of a second per line.

Q And then how long in duration -- well, let me ask this: Can a row be sensed more than once while the strobe remains on the column, for that period --

A. You're now referring to the switches here, which is where we do our sensing.

While this column is active, the switches attached to that column can be read on the switch wires, which is, again, timeshared, just like the lamp wires are shared.

And since it's on for a very long period of time relative to the microprocessor instruction, which is,

let's say, a millisecond, or a thousandth of a second -- and a thousandth of a second is the same thing as a thousand millicnths of a second. So you have a thousand millionths of a second, but the instruction cycle time is only around ten millionths of a second.

And, of course, we can sample a particular switch several times --

Q. While the strobe remains on that switch.

A. Yes.

Q. And how long in duration did you say it is between the sensings of a row?

A. Well, I'm not sure I quite understand that, but between columns for example, that would be a thousandth of a second; and between samplings on a particular column you could do that as quickly as within twenty millionths of a second.

Q. All right. The latter was what I meant.

How many instructions per second does a microcomputer do?

A. It does about a hundred thousand instructions per second on this particular microprocessor.

Q. Does one sensing of a row require one instruction or more than one instruction?

A. There's a single instruction to sense a row, but you have to also take an additional instruction to save that answer if you're going to read it again, so there would be a

two-instruction separation between reading.

Q. Between reading. So you have a total, if you want to sense twice, while the strobe is on the switch, you would have -- you'd need three instructions.

A. Yes.

Q. What happens to the switch closure information after you double sense it, as you described?

A. We have to make some decisions based on reading that information.

We would first check to see if they were both the same. If the readings are both the same, that implies that it's probably not noise.

Q. Well, let's take it one step at a time.
On the first -- does the computer memorize the first reading?
A. Yes. We execute an input instruction, and we read the sample. We save that in one of the computer's registers, and then we do a second input instruction, and we compare those two.
Q. You compare the result of the two samplings.
A. Yes.
Q. And what do you do then based on that comparison?
A. If the data is the same, we assume that it's valid, and act on it.
But if it's returning to a zero condition, which means that the switch is now opening again, we don't act on it.
Q. Well, let's see. If it's a one condition, does that mean the switch is closed?
A. Yes. When the switch first closes it goes from a zero to a 1; we can see that it changes from a switch memory, and we act on it right then.
Q. Did you act on it -- all right.
Now, if both sensings show a switch closure, what do you do?
A. We compare it, first of all, to a memory of that switch before.

If the switch was originally open and is now closed, we know that it's changed state, and now we act on it.

Q. All right. And then what do you do if you get a different reading?

A. Well, the switch will stay closed for awhile, now, so we'll memorize now that we've acted on it and it's closed; and as we scan around we'll see that it's still closed, but eventually the switch will open up again, as the ball rolls over a switch or whatever.

When we see, now, that the switch is opened successfully, then we'll compare it against the memory and see that it was previously closed, and now we'll sense that it's done, and we'll memorize now that it's now open.

We don't do any further game processing at this time, because it was already processed. But you do have to remember, now, that the switch is cycled.

Q. All right. Now, you told us a minute ago you took, while the strobe is on the switch, you take two sensings, right?

A. Yes.

Q. And let me take it again to be sure I understand it.

If both sensings show a switch closure, what happens?

A. It says that the switch data read is valid.

Q. And then does -- is an action taken on that reading?
A. No. No, not on that reading. That just says that the data that we read is valid.

We now have to find out whether or not we've already acted on it.

So now what you have to do is compare it against the memory of that switch condition that we have inside the computer and see if the switch was closed previously or was it opened previously.

Now, the switch was closed before; that we're reading it validly closed now means we still do nothing. It's already acted on.

But if it was open previously, we're saying that it's closed now, that means that some action has to be taken, because it's different.

THE COURT: What does the acting? What part of the mechanism here does the acting in response to this signal? You say, "We act on it."

THE WITNESS: This is the microprocessor.

THE COURT: The microprocessor.

THE WITNESS: And the program.

THE COURT: It takes the next step in response to that signal, is that it?

THE WITNESS: Yes.

THE COURT: Okay.

BY MR. TONE:

Q Are the techniques you just described shown in the Intel manual?

A No.

Q Did you learn this in some other manual or book, or did you think of it yourself?

A This is something I thought of myself.

Q Now, let me turn to the subject of bounce.

What is switch bounce?

Before you do that, I am going to turn this back to a drawing you made of noise, just to use that as a basis for comparison.

Go ahead now and tell us what switch bounce is, and when you do that, you can draw on the lower part of that sheet, which is marked 428, an illustration.

A. The switches consist of leaf springs that have contacts at the end of them.

Let's take an example of a target switch. When the ball hits the target switch, it is going to push that contact into the back contact, in other words, close the contacts. But it does this very quickly. These are metallic. So they bounce off of each other, very similar to bouncing a rubber ball off a floor.

Depending upon the springiness of the material and what not, the bounce can really be pretty severe.

The bounce is a valid closure. While the switch is bouncing, it is a valid closure, and we can act on it at that time; but the problem is that we do not want to act on it several times.

So this is a kind of noise but not really as miniscule or as microscopic as noise is. This is a very long time we are talking about here. A switch can bounce for several thousandths of a second.

Q. By a long time, you mean relatively long time, relative in relation to a noise spike?

A. Yes. A noise spike is in the area of billionths of a second whereas we are talking that the bounce can be in thousandths of a second. So there is a million-to-one disparity between their lengths. for example -- it could be that outrageous -- or a hundred thousand to one anyway. It

is a very long time bounce, but
the problem with bounce is that it can look like the switch
is closed. Then you can see the switch open again, and then
you can see the switch closed again.

Q. Because you take the readings so fast?

A. Yes, because the computer can read pretty quickly.

Now, the problem with that is the second closure looks like a new activation, but it really isn't. It is just part of the same one. You might give someone two coins instead of one, if it is a coin switch that is bouncing, or you might give him two scores instead of one.

So bouncing is something we have to protect against.

It might be best if I gave an example of what the bouncing switch looks like.

Q. All right.

A. When the signal is low, that implies that the switch is not active, and as the switch starts to go active, it is going to now bounce. So it will go up to an active condition and go down to an inactive condition and do this several times, just keep bouncing. Eventually, it will settle down, and then it will stay closed.

That happens now over a very long period of time relative to this time frame up here.

That they are on the same drawing, I hope that it is not confusing you since we are talking thousandths of a second here, and we are talking millionths of a second here.

Q. You are talking millionths of a second with respect to noise, which you have illustrated in red on Plaintiff's Exhibit 428, and thousandths of a second with respect to bounce, which you have drawn in blue on that exhibit, right?

A. Yes.

When the switch now closes or opens up again -- excuse me -- there is also a little bit of bounce. It is not nearly as severe. It might bounce a couple of times, and the switch is now open again.

Now, since this time of the bounce is so long, we can read the switch twice like we do here very quickly within one of the bounce regions.

Now, even these two arrows as indicated are far apart compared to what this would actually be. It would really be very readily able to read a bouncing switch as a closed switch.

So what is important to solve bounce is that you must not act on that switch again at this time, so that you do not read, for example, an open condition, and then when you see the closed condition again, that you think it is another closure.

So it is important now that once you act, you have to wait for a period of time to make sure that you would still see the switches closed if it was continuing closed or now truly open again.

Q. What do you do in your system to deal with that?

A. We do double sensing, first of all, to make sure we act on it right away, which is important to make sure that we can respond with a solenoid right away, such as the thumper-bumper in the middle. When the ball goes in, it hits the thumper-bumper switch. We respond by turning the solenoid on. That pulls the plunger down and kicks the ball out of the thumper-bumper. That has to happen very quickly, within a few tenths of a millisecond.

If it doesn't, the ball could bounce out on its own accord very softly, not really get hit, and it would appear sluggish or dead on the playfield. That is a very undesirable play response for a pinball machine.

So what we do is we sample, and as soon as we see that anything is active here and not noise, we act on it immediately. Then after we act on it, we debounce. In other words, we don't act on that switch at that scan again. We go through the entire multiplex cycle, and on the next multiplex cycle, then we first look at that switch again. This gives the bouncing time to settle down.

Q. Does the Intel manual teach debouncing?

A. Yes, although not this kind of debounce.

Q. That was the next question.

Does it teach the method of debouncing that you have described?

A. No, they do not.
Q. Wherein does the teaching of the manual differ from what you have described?
A. The manual suggests mixing up the noise sorting and the debouncing as a single function through several scans of the matrix to guarantee that the bounce is terminated before you act on it.
If we were to do that in a pinball machine, the reaction time may be too sugginsh or too slow. For example, three times through the matrix would take you 45 milliseconds. The ball could be in and out, or on a target switch, the ball may have already bounced off and so you may not see the actual closure. You could miss the closure entirely if you were to debounce in that fashion.
Q. If you wait to act until the second sensing?
A. Or several scans they say.
Q. Or several scans. I said sensing. Scans should be the proper word.
A. Yes, several sensings, not just double sensing.
Q. All right, you may resume the witness chair, please.
We have been talking about noise and debouncing on the input side. Is there also a problem with noise on the output side?
A. Yes, there are two problems.
The lamps are a problem we have to deal with

since they are on an output port with a latch and they can memorize a noise glitch, and the solenoids are also a problem, in fact, the one that we are most concerned with from a hazard point of view since, as I mentioned earlier, they are only intermittent duty solenoids and if they are left on continuously, it is just like a toaster. They will actually cook and they will start a fire.

So we had to deal with those two problems.

Q. How do you deal with that problem? Let's take first the lamps.

A. The lamps are taken care of by the fact that the desired lamps that you want to light up in the matrix are memorized in a bit map in the computer's memory.

Now, bit map is that there is one bit of memory. It is like an on and off switch. It is turned on in the computer's memory when you want a lamp on, and it is turned off when you want the lamp off.

If there are 64 lamps, there has to be a memory inside the computer of these 64 bits, one each for each of the lamps.

In the multiplexing process, we read this bit memory and we put this bit memory now out to the lamps. If in the process of doing this there is a noise glitch and the data going to the lamps gets confused, it would only be for that one scan cycle. The very next time around, the bit memory would try to rewrite it and probably would write it

correctly the next time. So the noise glitch would have a very momentary effect and would probably not be visible.

Q. Can that be described as a self-cleaning feature?

A. Yes, we have used that term before.

The fact that the bit map continuously refreshes what it wants to see out there automatically cleans up any noise conditions that exist out there.

Q. You spoke of the solenoids. Tell us how that problem was dealt with in your system.

A. The solenoids are direct driven. They are not multiplexed, and so taking advantage of the multiplexing automatically refreshing what you want to see out there is not quite as direct or as obvious.

The important point here is that the solenoids have to be dealt with specifically. The way we did this was that at any mux cycle, we output what we expected the condition of the solenoid to be or which solenoid to be on.

Now, most of the time there is no solenoid on, so most of the time we were putting out continuous zeroes. Now, this meant that if for some reason a solenoid got switched on accidentally, we would switch it off right away at the immediate next mux cycle, or if the proper data was supposed to go out there but didn't get out there, we would correct it immediately on the very next mux cycle. That data was put out continuously.

If we wouldn't have done this, what would have happened and what is normal is that you put out the data that you want the solenoids to be once, and when you do that, the solenoid turns on. Then when you want it off, you put out again, say "turn off," and you put that out once.

Now, if for some reason that got confused and that command didn't get out there, the solenoid would just stay on, and if it stayed on, it would burn up.

The other problem is that let's say that you didn't put anything out there. You didn't want to turn the solenoid on; it turned itself on because of noise. Well, if you don't continuously tell it to turn itself off, it would stay on again forever, the computer not realizing that it was ever on.

So this process is also a self-cleaning process. By continuously telling the solenoid port what you want, if something wrong gets out there, it is immediately corrected or immediately cleaned up.

MR. TONE: Good.

Mr. Katz has noticed, your Honor, that there is a witness, a Paul Dussault, in the courtroom.

I am sure he is there without knowing about the exclusion rule, and I ask that he be reminded.

THE COURT: All right.

MR. GOLDENBERG: I am sorry. There is a misunder-

standing here, sir.

I thought we had a conversation that one witness from each side --

MR. TONE: We did. Is he the representative of Williams?

MR. GOLDENBERG: He is a representative of Williams.

MR. TONE: I wasn't aware of that.

MR. KATZ: But he is not an officer and he is the witness that is going to be testifying with respect to the non-infringement of their games.

I thought we were talking about officers of the company to be representatives.

THE COURT: Well, it ought to be somebody who is in authority at the company and represents the company.

MR. KATZ: He is the witness, your Honor, that they were going to provide on the Black Knight, and he is going to testify on the critical questions of infringement.

THE COURT: Well --

MR. GOLDENBERG: Your Honor, I have no --

THE COURT: Go ahead.

MR. GOLDENBERG: If this troubles them, I really thought it was all made quite clear yesterday, but apparently there was a misunderstanding and if you have any questions or the plaintiff does, then I will ask Mr. Dussault to withdraw; but --

THE COURT: Well, very often the corporate representative is also a fact witness. I don't know whether there is a hard and fast rule on that. I mean, I am sure there isn't a hard and fast rule.

MR. GOLDENBERG: Your Honor, it --

THE COURT: Usually the test, I think, is whether counsel needs the assistance of the witness. Sometimes on these technical situations you don't just want somebody sitting there looking like he represents the corporation, but you actually turn to him for consultation from time to time.

What is that situation here?

MR. GOLDENBERG: Your Honor, the Rule does provide-- the Rule does not authorize exclusion of a party who is not a natural person or, two, an officer or an employee of a party which is not a natural person designated as its representative by its attorney, and I thought that was made quite clear yesterday.

So employees --

THE COURT: Well, the word "employee" is contrary to my recollection of the Rule. I thought it had to be somebody who would be able to represent the corporation on some fairly high level. So my recollection of the Rule is incorrect.

MR. KATZ: Your Honor, but I thought that the purpose of the Rule was to prevent the testimony from being affected, the testimony of the witness from being influenced by --

THE COURT: Well, except that there is obviously some tension between the exclusion rule and the representation rule.

I don't know. In view of the --

MR. KATZ: We would have no objection to some other witness --

THE COURT: It seems to me if you read the two rules together, you have to resolve this conflict in favor of allowing the witness to remain if he is the one designated by the party. I don't see where the exclusionary rule makes any exception in the case of a fact witness.

Think about it a minute. Why would you have somebody here who knows nothing whatever about the case and who isn't going to testify?

Once you accept the basic proposition that you can have as a representative somebody who is going to testify, now you are talking about degree. You are talking about whether he is an important witness or a witness of lesser importance.

I can't make those determinations at this stage of the case. So I will overrule the objection and allow him to stay, and I will do the same thing for the plaintiff.

MR. TONE: Very well.

BY MR. TONE:

Q Are there general noise considerations that affect both input and output?

A Yes.

Q Tell us about those.

A. As we mentioned before in conjunction with the regular pinball machine, the devices on a pinball are very noisy within themselves, such as the solenoids and the turning of the lamps, turning them on and off.

One way to isolate that noise from the electronics is to physically place the electronics in a different place, and we have accomplished that in the Flicker pinball machine by placing the electronics package in the back box, which is the glassed-in score display zone; whereas the power supply and the playfield is in the bottom box or the bottom cabinet.

Any noise generated by the solenoids or by the power supply, also located in the bottom box, are now spacewise isolated from the back box.

In addition to that, there are relatively large currents that the mother board that we looked at yesterday has to drive to the bottom box to turn on the solenoids and lamps. So an additional precaution is to isolate the logic from the main board by putting on a daughter board isolated from the mother board. This prevents excessively large currents from causing false logic performance of that actual logic board.

Q. Is there any other noise prevention or noise effect prevention measure related to hardware?

A. In conjunction with the Flicker?

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Q. Yes.

Well, yes, I think the question is: In your system -- and the Flicker, I take it, is an exemplification of your system.

A. From the logic -- no, there's no other things that I can recall at this time. That's pretty much it.

Q. And you've exhausted your recollection at this time?

A. Yes.

Q. Was anything done with respect to column drivers?

A. This is on the output side again. The general -- I thought the qustion was for the general --

Q. All right. It was. And I misunder -- I -- the fault is mine.

We have not mentioned, I think, column drivers. Explain -- those are on the output side, you say, and then would you tell us what they are and what you did about them.

A. Yes. In conjunction with the output devices, output displays, they draw some very large peak currents.

As was mentioned earlier, to make them look as bright you have to give them 16 times the power for 1/16 the time. That averages out to unity, which means that they're at their normal brilliance.

But 16 times the power can be quite a surge, when you first turn a lamp on, for example, since lamps, when they're cold, draw more current than after they're warmed up.

And so they call that cold starting current. Now, to limit that cold starting current we use low beta transistors to allow a soft start. Otherwise the currents could far exceed 10 times their normal operating current.

We limited it down to something substantially less than that. Now, by that surge current being reduced, the noise associated with that surge current is also reduced.

Q. When your deposition was taken in this case, Mr. Frederiksen, you were asked whether a competent electronic designer would not be familiar with noise problems, and you answered that he would; and then you were asked what were the techniques -- what were techniques for taking care of noise problems, and you listed some.

Do you recall that?

A. Yes.

Q. You listed RC networks. What are RC networks?

A. It's a filter network consisting of a resistor and a capacitor, or a series of those. And its purpose is to try to prevent the noise spike from getting through that filter network.

Q. Did you use those in your design?

A. No.

Q. In your opinion would they have been effective to eliminate the results of noise from a pinball game system?

A. In my opinion they wouldn't have worked in this machine,

since we were multiplexing.

Q. All right. You mentioned line filters, main power line. Are those associated --

A. Yes.

Q. -- those terms?

Explain what you mean by that.

A. These are power line filters. They're something that we use quite a bit today because of FCC regulations.

It was not a common practice to use them in those days, since the FCC didn't require that.

They do eliminate noise radiation problems, in other words, interference from this machine to other equipment such as TV sets and police radios.

Q. In your opinion would they have worked in your multiplexing system?

A. Well, they would have worked in as far as they would have prevented this noise from radiating out. But they would not have prevented the false switch activations.

Q. You also mentioned grounding of the main electronic chassis to the AC ground to dump static discharges.

Did you use that method in your system?

A. I don't recall doing that.

Q. Would that have corrected and eliminated all the noise problems from your system?

A. No, it would not have.

Q. You listed shielding to prevent radiation in electronics.
Did you use that method of noise prevention?
A. No, we did not.
Q. Would that have been effective in your system?
A. It possibly could have helped the problem, but it would not have solved the problem that we were facing. We needed a much more stringent technique than that.
Again, you know, the noise is a statistical thing. It would have helped to reduce the density of the noise, but the switch reactions to the noise would still have been there.
No, it would not have helped the problem.
Q. You mentioned ferrite beads on lead-in wires.
Will you describe that method?
A. A ferrite bead is a piece of electromagnetic material or magnetic material that is actually baked like ceramic. They can form these in the shapes of little tubes or beads.
They are kind of useful in that they absorb RF energy or noise energy. You can slide these over the top of a wire at any convenient point to help reduce some of the noise content.
Again, this reduces the density of the noise, but it does not allow any protection against whatever noise does get through from causing a falsing. So, no, that would not have solved the problem either.

Q. You mentioned in your deposition voltage transient suppressors on different power supply wires.

Will you describe that and state whether that would have solved the problem?

A. Voltage transient suppressors are primarily to protect the power supplies. They are not related to the switch sensing circuitry and would not have solved the problem.

Q. Finally, you mentioned proper distribution of filter capacitors.

Would that have solved the problem? What are they, and would that have solved the problem?

A. The filter capacitors or bypass capacitors are primarily to prevent power supply noise from affecting the logic. They do not protect the switches from receiving noise and so would not have fixed this problem.

Q. What is a stuck switch, turning now to a different subject?

A. A stuck switch is a permanently closed switch due to a malfunction.

Q. Is that a problem in pinball games?

A. Yes, it is, for two reasons: First of all, the pure statistical reason that there are a lot of switches in a pinball, and the second reason is that the switches on the playfield take a tremendous amount of abuse because of the fact that we are dealing with a ball projectile that can do a lot of very hard hitting.

Q. What is the result of a stuck switch in a pinball game?
A. As we witnessed on the electromechanical Flicker yesterday, a stuck switch can keep a solenoid activated. So it could cause a coil to burn out.

We had to protect against that.

In the microprocessor versions, you have to be careful that a stuck switch does not cause a computer program to hang up and not cycle any other switches, in other words, make the machine inoperative.
Q. Would those be the only results of a stuck switch, only undesired results?
A. Well, there is the obvious thing that if it is not affecting a solenoid and it does not make the machine inoperative, a stuck switch makes the game less enjoyable to play.
Q. Was there anything about the Intel MCS 4 system that could create a special problem with respect to stuck switches?
A. Yes.
Q. What was that?
A. They have a keyboard instruction.
Q. Now, to refresh the Court's recollection, this is the chip that was used in the Flicker, is that correct?
A. Yes.
Q. All right, go ahead.
A. They have an instruction called KBP, which stands for

keyboard process.

The purpose of that instruction is to check these, for example, four wires that I have shown in the matrix and to see if one of them is closed.

Now, what it is going to do --

Q. I am going to turn back to the drawing of the matrix, and we are speaking now of the four switch lines?

A. Yes.

Q. All right.

A. We read those. By using the keyboard instruction, we can read those in a single instruction, in other words, saving or conserving computer instructions, which is important since I have this time constraint to multiplexing fast enough.

We can read the switch in. Now, if one of those switches are stuck, the keyboard instruction will read it as being closed validly. But, now, if the second switch closes validly, the ball actually rolls over another switch, there are two switches closed.

Now, the keyboard instruction does not like two switches closed at one time. That is like hitting two keys on a typewriter. It responds to that by telling you that you have an error condition and, therefore, does not allow any of the switches to process.

Q. Was there any reason for having that KBP instruction

in the Intel chip?
A. Yes, there was.
Q. What was the reason?
A. The reason is that the Intel chip was used in calculator designs where they had a keyboard that they had to make sure only a single switch was closed.
Q. So if the operator of the keyboard accidentally touched two keys at the same time, the KBP instruction told the calculator to ignore the signals, right?
A. That is correct.

Q. Now, why did this KBP instruction create a problem or a challenge with respect to using the Intel switch or the Intel chip in a pinball game?
A. The alternative to using the KBP instruction was to program the machine to look at each wire separately, which would have taken many instructions.

So I had to use the KBP instruction in order to keep the length of code small and execution time quick.

The reason it ended up being a problem is, of course, that on a pinball machine, if you do have a stuck switch and another switch does now legitimately close, we are not going to the score for that switch, but we did get around that problem.
Q. How did you get around that problem in your design?
A. We had an alternative of memorizing the fact that the stuck switch was the switch closed, and then if we saw an error condition not changing the memory, or we could say that we would allow ourselves to change the memory.

Again, with the switches, there is a bit mat very much like the lamps that we memorize the conditions of the switches. We talked about this.

If the switch memory is changed to indicate that we have a stuck switch condition, when that switch goes away now, it sees the original stuck switch again as a valid switch closure. Then we act on that stuck switch

a second time.

Now, one trick we did is we actually, for example, put the four target switches on a single column, so that --

Q. Excuse me.

Do the four target switches give equal scores?

A. Yes. They all give a score of, I think, 500 points.

Q. Is that the reason you put them on the single column, on the same column?

A. Yes.

Q. All right. Go ahead.

A. By putting the four target switches on the same column, if one of them is stuck and a second one closes, you do not see that. But when the second one goes away, if you memorize that stuck condition, it would come back now and activate on the stuck switch giving you the 500 score or some appearance of operability, which made the player happy.

Q. All right. What else did you do?

A. Well, there were some very critical switches, too.

Q. What were they, for example?

A. Well, the tilt switch and the coin switch, and there is a slam switch, somebody trying to kick in the front door, which is not an uncommon thing.

These games take a tremendous amount of abuse in the field.

We had to make sure that if there was, for example, an abuse in progress, such as somebody trying to kick the door or the slam switch was closing, that we would not allow a coin switch. It was a very common thing for people to pick up the cabinet and drop them, hoping to make the coin switch activate.

That sounds pretty abusive, but they would actually do that. So we would have to find out by these other sensor switches and decide -- which had masses tied to them -- whether or not the game was being tilted or the game was being dropped.

Q. All right. I think you said you did something with these critical switches. What was that?
A. Well, that includes the door slam switch and the tilt switch and the coin switches. We tied those to a special wire where they could not get confused with other such switches, called the test wire on the microprocessor.
Q. And did the test wire in the microprocessor use the KBP instruction?
A. No, it did not.
Q. Was there any other method of dealing with the KBP instruction that was in the Intel chip?
A. Yes. There was -- on this particular Flicker game, for example, there are three pinballs, actually; the one that you're playing with and the two captive ones.

Now, one of those two captive ones could be activating certain switches while the pinball was activating another switch. And so we made sure that they were on separate columns, so that the KBP instruction wouldn't confuse them.

Also we had a spinner. A spinner is that thing I showed you yesterday where, when the ball hits it, it spins around and gives you multiple scores, depending on how hard you spin it.

That was put on a column all by itself so that it couldn't get confused with any other switch.

Again, if a switch is on a column by itself, or if the switches on a column are mutually exclusive, in other words, only one can be on at a time, the KBP instruction will work correctly.

Q. Were all these features that you have described relating to noise solutions and the bouncing and the KBP instruction incorporated in your design when you constructed the rebuilt Flicker according to your design?

A. Yes.

Q. You told us yesterday that there came a time in September 1974 --

MR. TONE: May I confer for a moment, your Honor?

THE COURT: Yes.

(Brief interruption.)

MR. TONE: Counsel believes that I overlooked a particular point with respect to noise. And so before I go on I'd like to go back to that.

THE COURT: Sure.

BY MR. TONE:

Q. Was there a noise correction technique called lag switch sensing?

A. Yes. We talked about that yesterday in conjunction with the two noise types, or the two noise correction types, the double sensing and the lag sensing.

And as I mentioned yesterday, the lag sensing

is waiting until the last moment during a column strobe or an active column time when the initial surge of current is now settled down; and as I mentioned yesterday, that surge of current on a wire is very much like a spring. And when you hit it, it bounces for awhile.

And at the end of the column time that bouncing has settled down quite a bit, and we can now read the switch more reliably.

So by delaying when you read a switch until the last moment in that column, you can read it more reliably.

Q. Very well. Now let's move back to September 1974. You told us yesterday about the noise testing techniques you used, the generator and the washing machine starter and the drill.

Did there come a time after that was done when the machine was shown to someone outside Milwaukee Coin, or outside Dave Nutting Associates, I should have said?

A. Yes.

Q. And to whom did you show the machine?

A. To representatives of Bally.

Q. And was that pursuant to a pre-arranged meeting?

A. Yes.

Q. Who was present from Bally?

A. Inge Telnaes.

Q. You better spell that, if you can.

A. I don't think I can.

Q. T-e-l-n-a-e-s, for the last name; and Inge is I-n-g-e.
Go ahead.
A. And Frank Bracha.
Q. That's B-r-a-c-h-a.
A. Yes. And Dan Conroy and John Britz.
Q. B-r-i-t-z?
A. Yes.

Q. And these were all representatives of Bally or Bally subsidiaries?
A. Yes.
Q. When did this showing take place?
A. On September 26, 1974.
Q. Where did it take place?
A. It took place in our alley shop in Milwaukee, Dave Nutting Associates.
Q. What happened at the showing or demonstration?
A. We set up the two Flickers very much identical to the way that they are in the courtroom here, side by side; and had the people play both machines.

And then they were asked to evaluate them as to what they thought the duplication of play was.

The machine was fully self-contained and all the covers were on.
Q. And by "the machine", you refer to the electronic Flicker, Plaintiff's Exhibit 333.
A. We had both the machines present --
Q. I understand that.
A. The mechanical and the electronic.
Q. But when you say "the machine was self-contained," you were referring to the electronic one that you had rebuilt?
A. Yes, that's correct.
Q. All right, go ahead.

A. Then all the people took turns playing the mechanical version, electromechanical version and the electronic version, and I explained to Inge Telnaes, who was their computer expert, about the operation of the pinball itself and the principles on which it worked.
Q. I hand you Plaintiff's Exhibit 28 -- I hand that up to your Honor -- and I ask you what that is?
A. This is a schematic of the Bally Brain that is in the Flicker pinball. Electronic version.
Q. When was it prepared? I notice it bears no date. Can you tell us when it was prepared?
A. This is not my writing on here, so I will assume that it was prepared as followup documentation after the fact of the demonstration.
Q. But the answer is you don't know when it was prepared?
A. No, I do not.
Q. But you recognize it, do you, as what you've said it was?
A. Yes.
Q. And does it correctly depict in schematic form the Bally Brain circuits in the electronic Flicker pinball machine?
A. Yes.
Q. Did you have any particular conversation with Mr. Telnaes and Mr. Bracha or with one of them during the

demonstration?
A. Yes, I did.
Q. Will you state that conversation?
A. The gist of it --
Q. Or tell us what you recall of the conversation?
A. The gist of the conversation was basically -- well, I was talking now to Inge Telnaes, explaining to him the theory behind the operation of the Flicker pinball machine.
Q. And was Mr. Bracha present while you were doing that?
A. Oh, he was in the same room -- the room is smaller than this room -- he was in the vicinity of the pinball machines, and I'm sure he was listening in.
Q. Were the other two gentlemen technical people, or were they not? That is, Messrs. Conroy and Britz?
A. No, they were not, not technical.
Q. All right. Go ahead, if you have anything to add to that answer.

You explained how the machine worked to Mr. Telnaes, and Mr. Bracha was in the room and within earshot of the conversation.
A. Yes.
Q. I now show you what has been marked as Exhibits 49, 50, 51 and 52. Will you look at Exhibit 49 and tell us what that is?
A. This is a block diagram of the interconnection of the

major Flicker components.
Q. And does that depict the Flicker design as it existed on September 26, 1974?
A. Yes.
Q. When was this drawing prepared?
A. In December of 1974. The date of the drawing is 19 December.
Q. Look at Exhibit 50. What does that depict?
A. This shows the wiring diagram of the cabinet switches and the playfield switches.
Q. That too bears a December date?
A. Yes.
Q. Does it show these features of the Flicker as they existed in September 1976?
A. Yes, to the best of my recollection.
Q. Look at Plaintiff's Exhibit 51. What does that depict?
A. This is now showing the output devices, the playfield outputs, which are the lamps and the playfield solenoids in the bottom left corner.

Q. Does that depict the Flicker as it existed in September '76 -- '74?
A. Yes, to the best of my --
Q. 1973?
A. This is '74.
To the best of my recollection, yes.
Q. I may have been addled on the dates. I have meant to say each time December 1974. Did you so understand me?
A. Yes.
Q. All right. This, too, is dated in December 1974, is that correct?
A. Right offhand I don't see a date.
I guess it is. There is a date, 19 December of '74.
Q. Take a look, if you will, at Exhibit 52. Can you identify that?
A. Yes.
Q. What is it?
A. This is the interconnect diagram, showing all the connectors on the different subassemblies and how you connect them together as a whole game.
Q. That also bears a December 1974 date?
A. Yes.
Q. Do all of these exhibits, 49 through 52, show the features of the Flicker as of September 26, 1974?

A. Yes, to the best of my recollection.

Q. I show you now what is marked as Exhibit 53, and I ask whether you can identify that?

A. This is what I mentioned earlier as being a mux chart or a way that we assign the input and output devices, the input devices being the switches and the output devices being the lamps and solenoids.

Q. This, too, is dated in December 1974, is that correct?

A. Yes.

Q. Does it depict the features of the Flicker as it existed on September 26, 1974?

A. Yes.

Q. Will you explain this chart in detail, having in mind that you testified yesterday about how you would assign various switches, lamps, and so forth in the mux chart?

A. As I mentioned yesterday, before you can do a pinball machine, you have to know exactly where every part is. Dave and I would go through the playfield and determine which switches were close to each other and which ones were best to cluster together.

Looking at the switches, which is the first grouping of four just below the test line -- in fact, let's start with the test line at the top.

The test line shows the critical switches that we had, which included coin switches and the other

emergency functions, like door slam and tilt and other important functions worth interrupting a machine for.

The next switches down were the actual playing switches that were mostly on the playfield. These switches are again clustered to guarantee they don't interfere with each other, such as the spinner, for example, is by itself. It could be activating while other switches are trying to close, and so we left that alone on a particular column.

The chart refers to the columns. Basically from left to right would be like Column 1 through Column 16. So all the switches vertically oriented are on the same column and would have to be watched carefully.

The next element down is how we assigned the solenoids to their 16 positions.

The bottom four grouping is the lamp map that we referred to, and this is how we actually placed the lamps in the lamp matrix. Again the four lamps vertically oriented are on the same mux line.

You can see on the very bottom of the chart is that the first mux line is mux line zero, and that is on the right side. Going towards the left side, the last mux line is labeled mux line F.

So zero through 9 and then A, B, C, D, E, F, that is how we labeled the 16 different multiplexed lines.

lines

Q. What you call lines look like columns to me.

A. Yes, these are actually columns of squares on this paper, which simulate the actual wires, which tend to look more like lines. That is the reason we kind of refer to them as lines, lines of wires.

Q. Referring to the columns now that you have just described as zero through 9 and A through F, to what do they correspond on your drawing, Exhibit 384?

A. They would correspond to the blue wires marked columns, or "COL." on the drawing, and they are labeled 1 through 4.

Q. In other words, they are columns here on Exhibit 53 and they are columns on your drawing 384?

A. That is correct.

Q. You called them lines. That is why I became confused.

Are these vertical rows, beginning with mux zero and working from right to left, ending with mux F, are they described as columns in the nomenclature of the matrix?

A. Yes. One other thing we didn't mention is there is a second single row just above the lamps, and that is where I placed the digits.

Again as I mentioned, there are actually seven lamps for each digit, but it wasn't necessary to draw seven rows since all the digit segments are tied together.

At the left edge you can see it is marked first player, most significant digit to least --

Q That is MSD in parentheses, right?
A. Yes, to the least significant digit, LSD.

Ball in play is next, and then the second player's scores were inserted there.

Then we have the match 10's. The other match was always zero, so that wasn't in here, just the 10's position, and then the credits are indicated here as well, the 10's and units credits.

These are how we used up the 16 digits that were available for the Flicker.

Q. This was, as I think we said, dated December 1974, and I apparently didn't ask you this question.

Does this chart depict the arrangement used in the Flicker as that machine existed on September 26, 1974?

A. Yes.

Q. I show you now Plaintiff's Exhibit 30. Can you identify it?

A. Yes, this is the program essentially as it existed at the time of the demonstration for the Bally Flicker.

Q. Is this the program that you submitted as part of your original patent application? Can you tell us that?

A. I believe so.

Q. Can you explain this program in very general terms briefly? To the uninitiated, it is completely unintelligible.

A. This is actually the way that we write a program, and it consists of what they call computer mnemonics or little shorthand words for the different types of things that you want to do.

For example, starting at the very top of the page, the first instruction, which has a comment next to it called "Main Program," has an FIM. That stands for "fetch immediate" from a register set, the first register pair, 1P, register pair.

One of the instructions that is a couple down from there is JMS, and that stands for "jump to sub-routine."

So this is a way of helping a programmer remember what he wants to program by giving him little mnemonic codes to remember them by. We write the program using those codes. This program then is run through the computer, called an assembler, and it takes these English-looking codes and converts them to the actual machine numbers that are the real program, and these numbers are then programmed into the PROMS.

Q I now show you Plaintiff's Exhibit 54.
Can you identify that?
A. Yes.
Q. What is it?
A. This is the production version of the Bally Brain that was proposed for use with the Flicker pinball machine. different from the Bally Brain, which is a prototype computer which has the E-PROMS. This has actually now the final ROMS that would be manufactured by Intel.
Q. Perhaps it is clear enough to the Court already, but would you state the difference between E-PROMS and ROMS?
A. The E-PROMS are electrically programmable. In other words, there is a part that already exists that you can put electrical currents into and program the numbers that we need now into those parts and put them into the computer. Those parts are very expensive, and they are not really practical for high-volume production, at least not in that day.
What, rather, was done is the E-PROMS were used to prototype a machine. Then when you went to production and you were satisfied that the code was what you wanted, you would send a copy of that code, both the E-PROMS and the paper tape, to Intel.
Intel then would make a mask. Now, as we talked about silicon yesterday, they would actually print the program on your own parts, and these are called now ROMS only

since they are not programmable any more.

Once they are fixed, they are fixed for all time. You cannot correct it. Those ROMS then would be used for the high volume production, and they are a much lower cost.

Q. Will you explain what part the paper tape plays in this process?

A. Well, as we mentioned that this program was converted to a bunch of numbers and it is programmed into the E-PROMS. The E-PROM does represent the program, but there is a risk that a bit for something might be lost. Since you are going to manufacture thousands of pieces, it is a common practice to dump it into a more secure form. One of those forms is a paper tape code, which has the same numbers, but it has some additional numbers to tell you where the code belongs in the part and a check sum to allow you to make sure that the numbers did not get distorted.

So there were some additional check features on the paper tape. The paper tape itself is something that comes off of a teletype machine. It is about an inch wide. It is a piece of paper, and it has actually a series of holes in it that are punched by the teletype representative of what the numbers are that you wish to demonstrate.

ate

Q. Was Exhibit 54 prepared by you or under your direction?
A. This document was prepared by me personally.
Q. When did you prepare it? Was it before or after September 26, 1974?
A. To the best of my recollection, this occurred before the demonstration and occurred before the prototype computer was built. This is how I modeled the Bally Brain from the target production computer.
Q. After the demonstration to Bally on September 26, 1974, did Bally acquire the invention?
A. Yes.
Q. Did it acquire the invention immediately?
A. No, they did not.
Q. What happened within the next year or two with respect to Bally?

Did it acquire the invention in 1974 or 1975?
A. No, they did not.
Q. Did you file a patent application for your invention?
A. Yes, we did.
Q. You do not remember when it was filed?
A. It was finally filed in around May of 1975.
Q. Did you design any other pinball games subsequently using your system that you have described in your testimony?
A. Yes, I did.
Q. Tell us about the other design machines.

A. I had designed a machine for Mirco.
Q. That is spelled?
A. M-i-r-c-o, which used an F-8 microprocessor. Using again a smaller design of the F-8 microprocessor system proposed from Mirco, I designed a home game for Bally called the Bally Fireball.
Q. What became of the Mirco design?
A. Mirco wanted to change the microprocessor, and they did that or they ran some units and then terminated their project.
Q. What occurred with respect to your relationship with Mirco?
A. Our relationship with them was also subsequently terminated.
Q. Turning now to the Bally Fireball, you said that was a home machine, correct?
A. Yes.
Q. Wherein did it differ from the arcade-type of machine that we see in the courtroom?
A. It did not have a coin door or the coin mechanisms. That was not required in a home unit.
It also had fewer mux lines. We tried to make it as low cost as we absolutely could for a home environment.
Q. Does that mean it had fewer lamps, digits, switches, and solenoids?
A. Yes. Its matchment configuration was 32 lamps, 32

switches, and 8 digits.

Q. Was it less rugged in construction than the arcade kind of machine?

A. From a ruggedness point of view. It may have even been more rugged. It used some newer design concepts, such as a printed circuit playfield, which allowed better volume production.

It used the same steel legs, the same kind of cabinet construction, the same playfield element, the same flippers and thumper-bumper and what-not. So I would not characterize it as being less rugged, just simply less expensive.

Q. Did the Fireball use the multiplex matrix system that you have described in your testimony?

A. Yes.

(Brief interruption.)

BY MR. TONE:

Q Mr. Frederiksen, I have handed you Plaintiff's Exhibits 426, 402 and 427. Can you identify them?

A Yes.

Q Tell us what they are. What's 402?

A 402 is a schematic of the electronic assembly for the home Fireball machine.

And 426 is the service manual for the pinball machine for the home.

And 427 is one of the original programs for the pinball machine before it was a Fireball. It was originally called Hocus Pocus.

Q But that was the same design project?

A Yes.

Q Its name was changed at some point from Hocus Pocus to Fireball?

A Yes.

Q Will you look at the schematic, Plaintiff's Exhibit 402; would it be correct to say that that schematically depicts the hardware for the Fireball?

A Yes.

Q Can you tell us -- can you compare that hardware with the -- looking at that schematic as needed to refresh your recollection -- with the hardball of the Flicker, the

electronic Flicker, Plaintiff's 333?

A The computer itself is on the left side. It's called the CPU, with its memory elements below it, PSU-1 and PSU-2.

PSU stands for program storage unit. It's the same thing as the ROMs in the 4004 system.

It also shows the solenoids in the bottom righthand corner, the playfield solenoids.

It shows, I believe, the lamps on both the lower playfield and the upper playfield, in the upper righthand corner, and how they're connected into the matrix, showing the matrix that they're actually connected in here.

It shows the lightronics displays, or the digital displays, just to the left of the lamps. It's called lightronics, DL6830. That was a custom 6-digit display, lightronics display that we ordered.

It shows their segment was connections to the left and their column connections downward.

There are some other elements: For example, the drivers that were used are shown in the left side. Those little triangles in the actual drawing refer to the power devices, but, you know, for space sake we only draw a typical example of one. And they're drawn to the left on the schematic, and we show then a detail of each one of the types of drivers that we use for powering the actual elements and solenoids and whatnot.

The power supply itself is in the bottom righthand corner.

Now, there is a peculiar difference here over the Flicker, that the sound effects were generated in software. These are now computer-generated sound effects.

And so in the bottom righthand corner you can see that there's a speaker. And the speaker replaced the chimes that were in the Flicker, since the speaker was much lower cost than that chime assembly.

There's some switches shown also up in the matrix area.

Q The matrix area, will you locate that for us physically on the document?

A Lower playfield, that's in the upper righthand corner.

There's two areas: One labeled "the lower playfield" and one "the upper playfield." The one just to the left there is the lower playfield.

Notice that in the far right side that there is the two -- these series of things that look like parallel lines. Those are the switch contacts. And they come down into the microprocessor part itself. And that's the switch input. Again, they're shown on the matrix.

And so this machine had lamps and switches and digits on this matrix.

Q Except for the features you have described as differing, was this substantially the same hardware from a schematic standpoint as the electronic Flicker?
A Yes.
MR. TONE: May I confer for a moment, your Honor?
THE COURT: Yes.
(Brief interruption.)
BY MR. TONE:
Q Referring to Plaintiff's Exhibit 402, Mr. Frederiksen, will you describe how the microcomputer scans through the matrix to activate the lamps and digital displays and switch -- and sense the switches? Walk us through that.
A First of all, we have to find out where the column drivers are. We can find those by most easily looking at the bottom of the digital displays. It's the lightronics part that we talked about, those boxes at the top center of the schematic.
You can see they go down to a part --
Q Would you point to that? Hold your copy of it was point to it. I think that will help me, at least.
A (Witness indicating)
Q Thank you.
A Those indicate the column drivers.
And we notice that there's eight wires coming off that column decoder, which is marked as a 7445.

Now, those column drivers go to the light displays here; they also continue on and go out to the external matrix.

Now, there may be some confusion here because the columns are now going to become rows. If you notice, they go to the right, from that part; they go through the connector -- that's what that big line of numbers is --

Q Hold yours up and point out the connector to us.

A Okay. The wires come off of this 1-of-8 decoder; they go through the connector here, this line of connections here; they go into the lamp matrix --

Q The line of connections is about two-thirds of the way across the page and is vertical.

A Yes, and showed with dashed lines.

That shows that we're going off the electronic board, now, to external connections.

Then it shows the columns as now rows on the matrix, and so you'd almost have to turn the paper this way, or vertically, to show you the columns. And then if you'd hold it that way, it looks quite clear.

Now you can see that the lamp wires now come off their rows, back to the machine to be powered up, and the switch wires --

Q Tell us -- point to the lamp rows ....

(Brief interruption.)

MR. TONE: Your Honor, I was asking myself why we have such a small version of this. And I'm told we do have a larger version, and I'd like to put it up, if you'll give me a moment to do that.

THE COURT: All right. Why don't we take about a five-minute recess.

MR. TONE: All right.

(Brief recess.)

MR. TONE: Your Honor, we are remiss in not having had a blown-up version of Plaintiff's Exhibit 402 that we could all see and that could be read in the courtroom when the witness began to give his explanation.

I would like to hear that explanation again, with the witness able to point to the chart. I have asked the court reporter to be available to read it in case your Honor would prefer that, or would you prefer to just have the witness go through it again?

THE COURT: Well, I listened to it, and to the extent that I am understanding any of this, I think I understood that as well as I did anything else.

MR. TONE: All right, so we will just pick up where we left off.

THE COURT: Just go ahead and pick up where you left off.

MR. TONE: All right.

THE COURT: I mean, it would be unrealistic to think that more than a fraction of this is comprehensible to me, and what fraction that is is anybody's guess, but --

MR. TONE: Your Honor and I are similarly situated.

THE COURT: -- my understanding was not diminished by the size of the exhibit.

MR. TONE: All right.

THE COURT: It is diminished by the size of my brain.

MR. TONE: All right, thank you. We will go ahead on that basis.

BY MR. TONE:

Q Do you remember where you were, Mr. Frederiksen?

A Yes, I believe so.

Q All right, go ahead then, using the blown-up version of the exhibit, Plaintiff's 402.

A The larger grouping helps me quite a bit since I was having a hard time making out some of the fine detail in the matrix area.

Q All right, if you need to back up to clarify anything, please do so and then go on with the explanation.

A I would like to suggest that this is a logic schematic intended for service, and so it is laid out as the lamps and switches are laid out on the playfield and back box.

So I would like to point out first where the clusters of things are since we talked about that we had to organize the matrix in clusters for convenience of wiring.

The playfield consists of these two boards. There were two printed circuit boards to put all the lamps and switches on on the playfield. The reason for that is that we could not afford the large amount of hand-wiring

to wire up all these switches and lamps on the bottom of the playfield.

We used two printed circuit boards since the playfield is very large and we just didn't want to make a board that huge. So we broke the playfield into two pieces. Those two pieces are called the lower playfield printed circuit board and the top playfield printed circuit board, but this whole zone here is the playfield.

Q Being the zone in the upper righthand corner?

A Yes. Now, the back box, on the other hand, has one electronic PC board that contains the computer and it contains a couple of setting switches here, as well as some lamps.

So we also have some of these components that are part of the matrix in the back box. So if there is any confusion here, it would be in that the matrix is kind of split up in these three zones.

But continuing along with the explanation, I said that as we have been talking that the columns that are now horizontal here are normally vertical, and so it might be easier to set this on edge to demonstrate that to correlate it a little easier.

Q You may do that.

A Now you can see that the switches on the lower playfield and the lamps on that lower playfield are organized

in columns, and we can see, as a matter of fact, that there is one, two, three, four, five, six columns associated with this lower playfield, and we have one, two, three rows of lamps and we have two rows of switches here.

Now, the upper playfield doesn't have nearly as many elements, but it does have some of the rows extended up there and five lamps and I believe we are seeing about seven switches.

Now, there is one little switch here that is all by itself. It is called the ball return. That is not on either of the printed circuit board. It showed off the boards altogether. That is wired up and plugged in electrically.

This ball return is the switch that the ball activates when it falls out the bottom of the cabinet and gets kicked out again for you to shoot again. It is removed from the printed circuit boards.

On the back box now where the digits are, we have this digital display. We also have some lamps associated with things like game over and whatnot, or in tilt, other things of that nature.

There are a couple of switches in the back box but virtually no switching done in the back box. Those are just setting switches.

We have, of course, the computer in the printed circuit board as we talked about.

I can turn this back again now.

We have also the solenoid drivers. This piece down here is separate from the matrix. It is not up in this zone at all, and this goes over to the solenoids, the playfield solenoids.

Q The piece down here is 7445?

A Yes.

That is something like a one-of-eight decoder, again, to give us this ability to have only one solenoid on at a time.

We can see that it connects the ball ejector and the different slingshots and the thumper-bumper and the flippers.

Q All of which are playfield solenoids?

A Yes. These are playfield solenoids, connects up those.

Also, the flippers are shown over here with these solenoids, but they are not connected back into this zone. They are turned on permanently, and the rest of the elements I believe we talked about.

Q Now, will you describe how the microcomputer scans through the matrix to activate the lamps and digital displays and sense the switches?

A Yes. The column scanning is done by the part labeled Q-280. It starts at what is labeled pin 1 and continues on through what is labeled pin 9.

Upon reaching pin 9, it will scan back to pin 1.

The pin numbers refer to the physical pin on the part, and so it may not necessarily be sequential in nature, but they are in this instance. There is one number missing. It is No. 8. I am mentioning it so you

are not confused by that.

This is equivalent to the columns that I had described earlier. These are --

Q To make them columns, it ought to be turned on the long axis, vertical?

A Yes, but these are basically from a schematic point of view where we put our column drivers.

The row drivers for the lamps are right down below it, and it is the four wires that go to a series of drivers now that drive the lamps, not only on board, but it goes off board and drives the lamps off there as well.

Notice that in the lower playfield only three of the four lamp wires are connected there. The fourth lamp wire goes to the upper playfield to kind of cluster these lamps together. This is part of this physical clustering that is important to optimize the wiring layout.

The digit display comes out of wires off the computer up to a 7-segment decoder. We actually give it a binary number, which only requires four wires, and we convert that to a 7-wire through a logic decoder, and that is the part labeled Q-260.

Now, that goes through a LED driver, light-emitting diodes. These are the red type of displays that are actually used on the Flicker itself, and drives them, the six, 7-segment displays located on the back box printed circuit board.

So we see that we had the column drive, the digit drives and the lamp drives. We have the digit and the lamp rows and the column drives which are strobed around.

Now, the switches are kind of buried in the lamp matrix, as we explained before. Here is one row of switches. It comes into the computer down here on the part labeled Q-285.

The second row also comes in down there, and there is a row of switches on the upper playfield, two rows of switches on the upper playfield, and they go to the other two inputs on the computer. So we can see there are four input wires for the input matrix coming off the playfield as well.

Now, there's some switches onboard that are put into the matrix directly. These are the test switches or the operator setting switches or the switches; they are also connected into the switch matrix.

MR. TONE: Your Honor, excuse me a minute.

(A brief interruption.)

BY MR. TONE:

Q. Mr. Frederiksen, would you make an explanation of what occurs from the time a ball hits a switch, that activates other elements of the game.

A. Okay.

Q. Just take it -- assume a ball hits one of your switches and then follow through from there and tell us what happens.

A. Let's assume that a switch S-11, located in the lower playfield, is activated. That's in the top row, it's easiest to locate on a very small drawing.

If that switch is closed, we will detect that upon scanning. For example, the top wire on the lower playfield matrix is a scan wire that has to be activated, which is on that part Q-280, the first pin or the top pin.

And so, as I mentioned, we sequentially activate these pins.

Let's assume, now, that we come around to pin 1 and activate that. That means that power will be applied to the top of the switch; if the switch is closed,

power will go through the switch and come out the bottom -- come out the bottom on one of the switch rows.

And that goes into the switch input logic here, and activates it, and then can be read by the computer as a switch closure.

We had to be in that column to read that switch.

Now let's assume as a result of that switch we want to activate the left slingshot. Let's say that was the switch associated with the left slingshot.

The computer then would read the switch and make sure it wasn't noisy and make sure it wasn't previously acted upon, so that you don't do it twice.

And if all this is true, then the computer's program goes into a routine that says, "Turn on the solenoid."

It will then output the solenoid number to this decoder, this 1-of-8 decoder, which is not very much different than the 7-segment decoder used for the digital displays, except that only one can be on at a time.

And if it were the left slingshot -- if I don't make a mistake here -- it would turn on the wire labeled 4 here; then when that turned on, it would turn on its power device and actually activate now the left slingshot.

It has to do this very quickly so that the

ball doesn't get out of the area before it gets a chance to kick it with a slingshot, for example.

Is that what you were looking for?

Q. Yes, that covers it.

Will you now describe, at the risk of some repetition, but while you have that matrix multiplexing arrangement before you, how the matrix is cyclically and sequentially scanned, and show it with the pointer.

A. Now, the columns are rows; and not to have to turn the drawing again, we would actually start by activating the top row.

Q. Turn the drawing. It would help, I think, to have the same arrangement you had with your schematic drawing.

A. It makes it easier, since columns aren't rows now.

Q. Right.

A. We would activate the left column here first; and then we would go in sequence down these columns, Column 1, 2, 3, 4, 5, 6.

Q. Now you're strobing.

A. Yes, we're strobing. We activate these sequentially, one at a time, and only one at a time.

You also notice that there's actually eight columns, but only six of them get to this particular matrix; the seventh column is now activated, and that goes to some onboard lamps on the backfield -- it goes to the onboard

lamps in the backfield only, as a matter of fact; and the eighth one also goes to the back lamps.

And so the seventh and eighth columns are just for the back zone.

And then it goes back to Column 1 and starts scanning the lamp matrix on the playfield again.

And it has to do this sequentially and, very similar to that demonstration that I showed earlier, it has to do this quick enough so that you don't get the lamp flicker.

It has to be faster than this approximately 60 cycle rate.

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Q. From looking at that illustration, can you have more than one matrix?
A. This is a singular matrix, but you could have more than one matrix.
Q. Does one of the PSU chips also contain a RAM?
A. The PSU chips are primarily ROM, and to the best of my recollection, the RAM content was actually contained in the microprocessor element itself. It had a large number of internal registers.
This is just to the best of my recollection. I don't have the book in front of me, but the RAM element actually --
Q. You can't tell from that schematic?
A. No, but I believe the RAM elements were located inside the CPU. These program storage units were really just the ROMs, just the program.
The RAM element that is shown on the Flicker is actually, I think, contained in the CPU in this one now.
Q. Would you then resume the stand, Mr. Frederiksen, and look at Plaintiff's Exhibit 426, which is the Fireball standardized test procedure.
Does that exhibit accurately describe the electronic operation of the Fireball pinball machine?
A. Yes, it does.
Q. What did Midway do with your Fireball design?

A. Originally, as we said, it was the Hocus-Pocus design and the actual final play value was tuned up for Fireball and then they manufactured it.

As a matter of fact, they manufactured it with several kinds of artwork, which is the unusual case. Normally a different artwork would be a different game.

With the Fireball, it had three or four different versions with completely different artwork, but they were all the identical game.

Q. Those games were manufactured and sold by Midway or Bally?

A. Yes.

Q. Approximately when did the sales of the Fireball begin, if you recall?

A. I don't recall exactly.

Q. Aside from Bally and Mirco, did you show your invention to anyone else in the period 1974, 1975?

A. Yes.

Q. To whom?

A. I showed it to a vendor that had come in to sell us some microprocessors.

Q. The name of the vendor?

A. There were two vendors. One of them was Fairchild, of course, and we subsequently used their microprocessor, and another vendor was Rockwell.

Q. You used the Fairchild microprocessor on what?

A. The Fairchild microprocessor was used on the Fireball game for Bally/Midway.

Q. You mentioned someone from Rockwell. When did that showing take place?

A. To the best of my recollection, it occurred in this 1975 time frame.

Q. Do you recall when in 1975 or can you pin it down any more than that?

A. It occurred at a time very much before we were ready for production with the Fireball since it was considered as an option for implementing that machine. In fact, I also remember considering it before I even selected the Fireball for Mirco, so it was before that time.

Q. You said the Fireball for Mirco.

A. I mean, excuse me, the F-8, the Fairchild part for Mirco.

So it was before that time as well. It was just around the time that we started contacting Mirco.

Q. You can't fix it on the calendar, though?
A. Not now. I can't recall.
Q. Who attended that showing where you showed your device or showed your system?
A. The local representative for Rockwell and then a factory representative for Rockwell.
Q. Do you recall the name of the local representative?
A. I believe it was Allen Peterson.
Q. Do you recall the name of the Rockwell factory representative?
A. No, I do not.
Q What did you tell them or show them?
A. I told them that I wanted to build a pinball machine using a microprocessor and that theirs might apply.

They came in asking us if we would consider using their part. So then I showed them on the board in that new facility now -- and this is different than the conference room blackboard that I used. It is the same blackboard, but now we have moved it to the new facility.
Q. The new facility being where?
A. This is the assembly facility of MCI around the corner from the original conference room discussions we had back in December the previous year.
Q. Still in Milwaukee?
A. Still in Milwaukee, just around the corner.

I showed him what I had intended doing with the pinball machine now, which was already implemented in conjunction with the Flicker, I believe, by this time, and told him what my requirements were as far as the number of lamps and switches and digits.

He then said that he would take the information back to his factory applications people and they would prepare a proposal for us as to how the microprocessor would work in conjunction with our system.

Q. You said you explained your system to them with the aid of the blackboard?

A. Yes, I did.

Q. Did you ever talk to them after this first meeting?

A. Yes, I did.

Q. What, if anything, did you tell them about your patent application?

A. I had warned him at the time that we had filed a patent. At the time that I had warned him, I am not sure whether the patent had already been filed or not, but it was imminent to be filed, if it had not just been filed, and I had thought that would have been at the time sufficient warning to prevent them from doing anything blatantly with the material I was giving him.

I asked him, of course, to keep the information confidential.

Q What was the subject of the later communication you had with the people representing Rockwell?

A. Some time later they came back with a proposal using their parts, which apparently was prepared by an applications engineer now at the factory itself, and after showing me the parts and now subsequently having seen the Fairchild part, which I preferred, I told them that I was not interested in their part and said that I liked the F-8 better, which is the number on the Fairchild part, and that we were going to go that way.

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Q. Was the patent issued ultimately?
A. Yes.
Q. What was in June of 1978?
A. Yes.
Q. I think you told us that that patent was ultimately acquired by Bally Manufacturing Company?
A. Yes.
Q. Corporation?
A. Yes.
Q. When did Bally acquire title to the patent?
A. They acquired title to the patent in conjunction with the purchase of Dave Nutting Associates several years later.
Q. Dave Nutting Associates was a corporation?
A. Yes.
Q. Of which you were a 50 percent owner approximately?
A. Yes.
Q. What consideration did Bally pay for the stock of Dave Nutting Associates?
A. 50,000 shares, each of us, which amounted to a million dollars each.
Q. That is 50,000 Bally shares?
A. Yes.
Q. In exchange for your stock in Dave Nutting Associates?
A. Yes.

MR. TONE: All right. May I have a moment to

confer, your Honor?

THE COURT: Yes.

(Brief interruption.)

MR. TONE: At this time, your Honor, we should like to offer the following exhibits that were identified during the direct examination of Mr. Frederiksen: Plaintiff's Exhibits 3, 7, 8, 9, 10, 11, 15, 17 through 23, both inclusive, 25-A, 25-B, 26-B, 28, 30, 45-A, 45-B, 49, 50, 51, 52, 53, 54, 326, 328, 332, 333, 384, 402, 426, 427, and 428.

THE COURT: They are all received.

(The documents marked for identification as Plaintiff's Exhibit Nos. 3, 7 through 11, 15, 17 through 23, 25-A, 25-B, 26-B, 28, 30, 45-A, 45-B, 49 through 54, 326, 328, 332, 333, 384, 402, 426 through 428 were received in evidence.)

MR. TONE: That concludes the direct examination, your Honor.

MR. LYNCH: Your Honor, I would like to object to several of those exhibits.

THE COURT: All right. I assumed there was no objection.

MR. LYNCH: I know that 7 and 8 and 9 -- or 7 and 9 -- I cannot remember the two -- 7 and 8, these are sketches that I would certainly want it understood that I do not

regard them as evidence. They are reconstructions.

THE COURT: I understand what they are. I mean, all the exhibits are received for what they are, and that is clear.

MR. LYNCH: That is fine, your Honor.

THE COURT: All right, they are all received.

CROSS-EXAMINATION

BY MR. LYNCH:

Q Mr. Frederiksen -- your Honor, initially, I would like it understood that it is agreed with counsel for the defendant that the claims that are involved -- there was an agreement prior to trial -- the claims that are involved in this litigation and which are asserted against the defendants, some against some defendants, some against only one defendant, as I understand it, without getting to that now, are Claims 45, 46, 47, 48, 49, 51, 53, 54, 55, and 95.

MR. TONE: That is correct, and I have advised Mr. Lynch and Mr. Goldenberg, your Honor, that we anticipate that we may be able to reduce the number of claims asserted. As soon as we have made a decision on that, we will advise counsel and advise the Court.

THE COURT: Very well.

MR. LYNCH: That is fine, your Honor. Anything that reduces the matter will be acceptable, but the agreement is, as I understand it, that those are the only claims in issue. And if liability is not proven with respect to those claims, then there is no liability under the entire patent.

MR. TONE: That is my understanding of the arrangement made with Mr. Katz and Mr. Schnayer. Is that correct, gentlemen?

MR. KATZ: Yes.

THE COURT: Very well. It is so stipulated.

BY MR. LYNCH:

Q. Mr. Frederiksen, just so we can get some perspective on the dates that we have talked about here, you demonstrated your Flicker game to Bally personnel in September of 1974, correct?

A. Yes.

Q. You undertook an arrangement with Mirco sometime in 1975, correct?

A. Yes.

Q. That arrangement with Mirco was generally unsuccessful, correct?

A. Yes.

Q. In 1976 you entered an arrangement with Bally under

which certain home games were undertaken and constructed, correct?

A. I believe that is the time frame.

Q. Those home games did not hit the market until the latter part of 1976, correct?

A. I believe so.

Q. About two years after the first demonstration of Bally, just about, correct?

A. Yes.

Q. So it was two years before anything even resembling a successful exploitation of your invention occurred?

A. No.

Q. What occurred before that?

A. The F-8 implementation given to Mirco was virtually identical to the F-8 implementation that was in the Fireball.

Q. The F-8 implementation in Mirco, was it successful?

A. If by successful you mean produced financially successful, no.

Q. Was it ever produced by Mirco?

A. In prototype volumes, yes.

Q. Was an F-8 version produced by Mirco, Mr. Frederiksen?

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Q Mirco produced the device with its own design, correct?
A Yes.
Q A 6800. Is that correct?
A Correct.
Q And so the first commercial exploitation that could even be remotely called successful of a design of yours occurred two years after the demonstration of Bally. Correct?
A Yes, commercially successful.
Q That could even be called remotely commercially successful.
A Yes.
Q Now, you've spoken a great deal about many aspects of your invention. And you defined it as matrix multiplexing.
A Yes.
Q Can one multiplex without a matrix, Mr. Frederiksen?
A Yes.
Q Is that part of your invention, in a pinball game?
A No, I don't believe so.
Q So it is multiplexing by maintaining switches, digits, lamps, the various items that must be activated in a matrix, correct?
A Yes.
Q If -- by maintaining everything in a matrix you only

need a driver for each column, correct?

A No.

Q Well, I mean, you do need a driver for each column.

A Yes.

Q And if you have a driver for each column and you have everything involved in a matrix, you save drivers. Correct?

A Yes.

Q Now, you indicated that multiplexing without a matrix is not part of your invention.

I'd like to refer you then to the patent. And let us talk about the claims -- if we can find the claims.

Do you have a copy of the patent before you?

A No.

MR. LYNCH: Your Honor, I don't know if the Court received a copy of Exhibit 3.

THE COURT: I haven't received that yet. Why don't you give me your --

MR. LYNCH: This is Plaintiff's Exhibit 3.

THE COURT: All right. Thank you.

I mean, I've received it, but I haven't looked at it yet.

BY MR. LYNCH:

Q I place before you a copy of the reissue '441 patent, which is Plaintiff's Exhibit 3; and claim 45 is the first claim in suit.

Do you have claim 45 before you, Mr. Frederiksen?

A Yes, yes, I do.

MR. LYNCH: May it please the Court, your Honor, I appear to have lost --

(Brief interruption.)

BY MR. LYNCH:

Q I'm placing a blown-up copy of claim 45 on the easel, also for ready reference.

Can you see that, Mr. Frederiksen?

A Yes.

Q Claim 45 provides for a pinball game comprising a processor having a programming means and memory means; and isn't it true that virtually every processor, microprocessor, has that in its operative state?

A Yes.

Q A pinball game always has a ball, doesn't it?

A Yes.

Q And a pinball game usually, in its old electromechanical versions, had a means for ejecting the ball onto the playing field whereby the ball may roll downwardly across the

playfield. Is that correct?
A Yes.
Q The pinball machines for time immemorial have had a plurality of response means for detecting the ball and having signalling means associated therewith.
A Yes.
Q Haven't they?
And these were operatively connected to the electromechanical logic in the old pinball machines, correct?
A Yes.
Q So the claim here, claim 45, says, "operatively connected to the digital processor." Correct?
A Yes.
Q So we're saying, just connect it any way you can, up to this point.
A Yes.
Q And the purpose of connecting that would be for signalling the processor that the response means had detected the ball.
A Yes.
Q Isn't that right?
A plurality of display means for presenting information based upon the detection of the ball by the response means and having display activation means asso-

ciated therewith.

Now, an ordinary pinball machine had that, did it not?

A Yes.

Q And "operatively connected to the processor for activating the display means in response to the signal from the processor."

So this merely says, instead of controlling the display in response to what happens on the playfield with electromechanical logic, let's generally control it with a processor. Correct?

A Yes.

Q Doesn't tell you how you're doing it yet, does it?

A No.

Q And multiplexing means "operatively connected to the processor for cyclically and sequentially enabling the signal means to signal the processor that its associated response means has detected the ball and cyclically and sequentially enabling the activation means to activate its associated display means."

That is the -- is that the statement of the multiplexing function?

A Yes.

Q I ask you to look at claim 45, Mr. Frederiksen, and tell me where it says there has to be a matrix.

A Just give me a second to think about this.

(Brief interruption.)

MR. TONE: Your Honor, may I have the question read while the witness is thinking?

THE COURT: Yes.

MR. TONE: And I'd ask the witness to go ahead and think while I'm hearing this, and perhaps --

THE COURT: Yes.

(Question read.)

MR. TONE: I object --

THE COURT: We want to be careful, now, about any speaking objections.

I'm sure you don't have that in mind.

MR. TONE: I think what I'd like to do is approach the bench --

THE COURT: All right. Yes.

MR. TONE: -- if your Honor will permit a side-bar conference. I want to avoid a speaking objection.

THE COURT: Yes.

(There was a sidebar out of the hearing of the witness.)

MR. TONE: The objection is really this. The question is put to a witness who is not an expert in the patent law. 35 U.S.C. 112 tells us how to read the word "means" in a means-plus-function claim, and to ask the witness where he finds a matrix in a patent that calls for a means of doing something, which enables the specifications to be read with the claim, without telling the witness that he is entitled to consider the specifications also, as the statute provides, is not a proper question when he is not a patent expert.

THE COURT: That is something you can go into on redirect. The question standing alone is proper. I mean, what it proves is something else.

MR. LYNCH: That is exactly right.

THE COURT: But it is a proper question. Overruled.

MR. TONE: All right.

(The following proceedings were had in open Court:)

BY MR. LYNCH:

Q Could you find it in there?

A No, I do not see mentioning of the matrix, but without a matrix, there would be more drivers, not less.

Q There certainly would.

Now I would like to ask you to look at Claim 46, Mr. Frederiksen. It is the very next claim.

We don't have a blow-up of Claim 46, but Claim 46 says:

"The game of Claim 45 wherein the signaling means --"

The signaling means is the switches on the playfield, correct?

A. Yes.

Q. "...and the respective response means and the display activation means --"

Those are the other pinball items, such as the chimes, the noises, the lights,and the numbers, correct?

A. I believe so.

The activation means, I believe, means the electronics that activates them.

Q. Fine.

"...associated with the respective display means are operably connected as a plurality of elements in a matrix --"

A. Yes.

Q. "...the multiplexing means having means for cyclically and sequentially enabling each set of elements of the matrix," correct?

A. Yes.

Q. So Claim 46 says that the device of Claim 45 can be further modified by incorporating these various devices in a

matrix, correct?

A. Yes.

Q. Perforce, the device of Claim 45 need not use a matrix, isn't that correct?

A. Yes.

Q. So Claim 45 then, which recites only multiplexing and not matrix multiplexing, defines something broader than what you regard as your invention, isn't that correct?

A. Yes.

Q. The commentary that you undertook on direct examination, in which you explained the matrices and all of the considerations that went into those matrices, do not apply to Claim 45, do they, Mr. Frederiksen?

MR. TONE: I will object, your Honor, to a question that I think calls for a legal conclusion.

THE COURT: I think that does call for a legal conclusion. I will sustain that objection.

BY MR. LYNCH:

Q. Let me ask this. All of the benefits that you discussed in explaining the matrices would not apply to a system that does not contain a matrix, correct?

A. Yes.

Q. You explained a number of items that existed over at the Flicker machine when it was demonstrated to the Court. Just so we can clarify this, Mr. Frederiksen, it is the case, is it

not, you did not invent any new kind of switch for a pinball playfield, did you?

A. No.

Q. You didn't invent any new kind of lamp display for a pinball playfield?

A. No.

Q. You did not invent a new type of solenoid that is used on a pinball playfield or in association with the interior workings of a pinball machine?

A. No.

Q. And you did not invent the digital-type display which is shown on the solid state Flicker and different from the rollover reel-type display that exists on the electromechanical Flicker?

A. No.

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Q Prior to the time that you undertook the development of the Flicker game, you were working on the IQ Computer game and the Super IQ Computer game, correct?
A Yes.
Q So the Court understands, the Super IQ Computer game was a game that had involved a cabinet, correct?
A Yes.
Q It was a coin-operated game that could be used in arcades or in various places for the amusement of individuals, correct?
A Yes.
Q One placed a coin in, and a display lit up, correct?
A Yes.
Q That display asked the user what category would you like to be quizzed on: U.S. presidents, capitols of the states, or baseballs players, for example, isn't that correct?
A There were categories. I do not recall exactly what they were.
Q Well, I mean, I just used those as exemplary.
A Yes.
Q Then the person would select which category by engaging a button or something of that nature?
A Yes.
Q Then the device would switch into a mode where ques-

tions in that particular category would be posed to the individual playing the game?

A Yes.

Q You could then give answers to the questions by pushing A, B or C, for example, is that correct?

A Yes.

Q That device, the Super IQ Computer, had switches in it, didn't it?

A Yes.

Q That could be randomly actuated?

A Yes.

Q It had lamps, correct?

A Yes.

Q It had solenoids, correct?

A Yes.

Q It had a display, a score display?

A Yes.

Q Did it have a digital display just like this one?

A I don't recall. I believe they may have been incandescent, but similar.

Q Similar.

So it had all of the items that this Flicker game has in it, all of the classes of items, let me put it that way, that the Flicker game has in it?

A Well, not exactly. It did not have a pinball, for

example.

Q It did not have a ball.

A It did not have something that resembled the switch pipes, such as spinner switches, which were a much speedier type of switch than I had in that machine.

As a matter of fact, most of the switches there were of more of a keyboard nature. They were not really of a pinball nature.

Q They were analogous to keyboard switches?

A They bounced less, more of that quality.

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Q. Well, we will get to switches. Now, we looked at Claim 45, and I asked you to look at Claim 46 as well.

The next independent claim involved in this assertion of infringement is of Claim 52.

Now, can you tell me if there is any recitation at all in Claim 52 of the existence of a matrix, electrical or otherwise?

I will point out, your Honor, Claims 53, 54, and 55 are in issue, but they are dependent on Claim 52, and consequently, we have to look at Claim 52 in order to ascertain 53, 54, and 55.

(Brief interruption.)

BY THE WITNESS:

A. Claim 52, very similar to Claim 45, does suggest or state that there is a display means, a switch means. And it, in fact, refers to, I think, a variety -- a couple different kinds of display means and that they are multiplex. Of course, that implies more than one row, which means that there would be a matrix.

BY MR. LYNCH:

Q. Claim 52 now implies there would be a matrix, but it does not say so, correct?

A. It states that there is a display means, and there is a response means or -- let's see.

There is a response means for detecting the

ball and a display means and that these are multiplexed. That implies there is more than a single row.

Q. Well, we will pursue that in a moment, what it implies, but let's see what it says. At the end it says:

"The game further comprising multiplexing means for cyclically enabling at least some of said elements to perform their associated functions," correct?

A. Yes.

Q. So this says we only have to multiplex some of what we have discussed above, perhaps only the displays, and perhaps only the signaling switches, correct?

A. Yes.

Q. In fact, it nowhere mentions a matrix, and in that respect, it is similar to Claim 45, correct?

A. I do not see the word, matrix, mentioned in Claims 52 or 45.

Q. Now, Claim 53 indicates that the elements which are multiplexed may be only the signaling elements, isn't that right?

A. Yes.

Q. In fact, under that circumstance, there is no recitation at all about how the other elements, the display elements, would be treated?

A. It appears to say that, that is correct.

Q. Claim 54 says that only the display elements would be multiplexed?

A. Yes.

Q. There is no discussion or treatment of how the other elements, for example, the signaling elements, would be treated, isn't that right?

A. Yes.

Q. Claim 55 says where we are going to multiplex both of them?

A. Yes.

Q. In none of these set of claims, 52, 53, 54, and 55, is there an indication expressly that there be a matrix, is that correct?

A. I don't see the word "matrix" mentioned in them.

Q. It is not mentioned as it is mentioned in Claim 46.

A. No.

Q. It is correct that it isn't mentioned?

I am sorry. We are getting a double negative, Mr. Frederiksen.

It is not mentioned as it is mentioned in Claim 46, correct?

A. Yes.

Q. I would like you now to refer, Mr. Frederiksen, to Claim 95, which is the last claim that has been asserted here.

Does Claim 95 indicate by its words that the elements, the signaling means or the response means -- I believe it is called a response means for detecting the mass -- or the display means should exist in a matrix?

A. Please give me a moment to read this.

Q. Certainly.

(Brief interruption.)

BY THE WITNESS:

A. I don't see the word "matrix" mentioned in there.

BY MR. LYNCH:

Q. When you defined multiplexing originally, you pointed out

that the type of multiplexing that you do is called time division multiplexing, right?

A. Yes.

Q. That means that you undertake to divide up the time, if you will, in which the processor is going to perform functions and you undertake to allocate units of time to each specific function and then do them kind of repetitively in a cyclic and sequential fashion?

A. Yes.

Q. If one had, for example, four lamps, as you illustrated in your matrix -- and I am going to draw these as symbols of lamps -- and just put them all in individual columns, one could multiplex those lamps, correct?

A. I am sorry. I can't draw any conclusion from your sketch.

T20

Q Well, I'm just saying, if this were -- these columns go up; one could light these lamps by multiplexing in the same fashion as your exhibit was lit.

A. Yes.

Q In fact, your exhibit involved eight lamps in a row; they were not in a matrix, were they?

A. No, they were not.

Q They were just eight lamps in a row, multiplexed. Correct?

A. That's correct.

Q And if you wanted to light up 16 lamps, you could put 16 lamps in a row, couldn't you?

A. Yes, you could.

Q And if you wanted to, at the end of that time period detect the switch closures, 16 switch closures, you could arrange those sequentially beyond the 16 lamps. Isn't that correct?

A. Assuming there was enough time to do that, or that you could do it quickly enough, yes, you could.

Q In which case one could go from lamp 1 to lamp 16 and then beyond that, from 17 to 34 and handle switches, correct?

A. Again, if it could be done quickly enough, yes, you could.

Q But that's multiplexing, is it not?

A. Yes.

Q. Multiplexing without a matrix.

A. Yes.

Q. Now, when you use two matrices -- strike that.

Everything that you indicated, Mr. Frederiksen, in your testimony in the Bally Flicker game and in the -- not the Bally -- the modified Flicker game and in the Bally Fireball game that you testified about at the end of your testimony involved all of the elements in a single matrix. Isn't that correct?

A. Yes.

Q. In the Mirco game for the F-8 version of the Mirco game that you sent to Mirco, that you testified about -- whatever state it was in, and we won't get into that; we'll get to that later -- but that game, everything was involved in a single matrix, correct?

A. Yes.

Q. And you indicated that by placing -- by reference to your Exhibit 384 -- by placing digits, switches and row lamps in a single matrix, you were able to take care of the switches, for example, in column 1 -- I mean the row lamps in column 1 and the switches in column 2 and the displays in column 1, with a single driver. Correct?

A. Yes.

Q. So if you took the switches, for example, you could put those over here in a separate matrix, couldn't you?

A. Yes.

Q. That would require a separate driver for each of the columns and the switches, correct?

A. Yes.

Q. And it would lose the economy of the single matrix that you discussed. Correct?

A. Not necessarily, since the drivers to drive a switch obviously are very low powered.

Q. So are you saying that in fact putting the switches in the single matrix did not effect an advantage, or did it?

A. It had -- it did have an economy of wire.

Q. It had an economy of wire and an economy of drivers, correct?

A. Again, I can't say as to whether or not the drivers would have been any less expensive if separate or combined.

Q. At any rate --

THE COURT: I'm sorry. If separated from what?

THE WITNESS: The drivers required for the lamps and digits are power drivers, since they're display devices. To simply activate a switch, which requires just very little current, you don't need those big power drivers; and so you could use the logic signals directly to activate the switches, but you could never do that, of course, with lamps or digits. They require power amplification.

BY MR. LYNCH:

Q. But the drivers for the switch matrix would have to be provided. Correct?
A. If by drivers you mean similar transistor devices that are in this column, no.
Q. Not similar. Something has to be provided, correct?
A. Yes, something has to be provided.
Q. And that something need not be provided when it's in a single matrix. Correct?
A. Correct.

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Q. Now let's go to the digits.

If one were to take the digits and put them in a separate matrix, one would need separate drivers for each of the columns of the digits. Correct?

A. Yes.

Q. And you testified that the digits are like very small lamps. Correct?

A. Yes.

Q. And so if one were to take the digits and move the digits to a separate matrix, does one realize the advantage that you testified about existed in your invention and in this single matrix?

A. It would not be as efficient an embodiment as explained here.

Q. Now let's take the digits as an example. The digits, which are the LED devices, which are incorporated in Flicker, are devices that you purchased at the time of installation. Correct?

A. Yes.

Q. Those LED digits are similar in operation to the red LED displays that were seen on calculators at that time. Isn't that right?

A. Yes.

Q. Now, at the time that you undertook to do this, you explained to the Court how each of the digits has seven

segments and those seven segments which, when all lit, form an 8 in the display, can be variously lit to provide all the integers from 1 through zero, 1 through 9 and zero. Correct?

A. Yes.

Q. And when all the items are lit, it forms an 8. Correct?

A. Yes.

Q. Now, at the time that you undertook to incorporate this display in the Flicker machine were there well-known pieces of equipment called 7-segment decoders that were used to drive displays?

A. Yes.

Q. Displays of this very type, LED displays, right?

A. Yes, there were decoders. Although I'm not sure whether or not they could have handled the current requirements.

Q. There were such decoders, were there not?

A. Yes.

Q. And those decoders accepted four lines into them which, via an encoded message, would activate the lines A through G, as illustrated on 384?

A. No.

Q. Well, let me --

A. No. No in the sense that those decoders were designed to drive a single digit, not a matrix of digits.

Q. In your experience was driving a matrix of digits new?

A. No.

Q. It was known to drive a matrix of digits, that is, 7-segment display digits, at the time that you incorporated the display in Flicker. Isn't that correct?
A. Yes, on the smaller LED displays.

Again, the difference here is power. These larger displays required more power.

A single 7-segment decoder could only drive a single display.
Q. We'll get to the power requirements later.

I just want to know whether it was known to provide decoding devices that -- these are 7-segment displays on the Flicker Exhibit 333?
A. Yes.
Q. There were decoding devices to drive 7-segment displays. Correct?
A. Yes.
Q. And to drive them in a matrix. Correct?
A. On smaller matrices, yes.
Q. But to drive them in a matrix. Isn't that correct?
A. On the smaller devices. Yes.
Q. And indeed, operationally those 7-segment displays were multiplexed, were they not?
A. Yes.
Q. In other words, what you are saying was -- let me put it this way: This display, insofar as the technique used, the

display in 333, insofar as the technique used to multiplex it, was similar to techniques used in smaller 7-segment displays in calculators. Correct?

A. Yes.

Q. Insofar as the mode used to decode the signal from the microprocessor, that display operates exactly the same as displays operated in calculators. Correct?

A. Yes.

Q. You are saying that in your application of the display, you had unusual power requirements?

A. Yes.

Q. What is the -- well, what's the basic -- strike that.

From whom did you obtain the displays that were used in Flicker?

A. From Fairchild, part FND 500.

Q.

500

Q. Were those devices designed to be illuminated in an application, the same way they were designed to be illuminated in Flicker?

A. No.

Q. They're not designed to be illuminated to show numbers?

A. If by illuminated you mean multiplexed to show the numbers that we're demonstrating --

Q. I didn't say multiplexed. I said illuminated.

A. Oh, I'm sorry. But I misunderstood you, since the Flicker illuminates them by multiplexing, I was confused.

Q. Yes. But when you bought the display, you bought it in order that numbers could be illuminated in the display you bought from Fairchild.

A. Yes.

Q. And the only difference between this type of display, the kind you bought from Fairchild, and the small kind that existed on calculators at that time, was the size and power requirements. Correct?

A. Yes.

Q. And what you did was use the same technique that is used on a calculator and make allowance for the power requirements. Isn't that correct?

A. Yes.

Q. But you did use the same technique that was used at that time in calculators; making allowance for the power require-

ments.

A. That many have been so. I was not familiar with the calculator at that time, but it may have been so.

Q. You are now familiar with the fact that that's what you did. Isn't that correct, Mr. Frederiksen?

A. I'm familiar with what I did. I'm not familiar with what the calculators did then.

THE COURT: Mr. Lynch, this might -- unless you've got just one or two more questions --

MR. LYNCH: No, your Honor.

THE COURT: -- it might be a good time to break.

MR. LYNCH: That's fine, your Honor.

THE COURT: We'll break until 11:00 o'clock tomorrow.

Let me give you the schedule here for next week.

You may stand down, Mr. Witness.

I've held off until my travel plans were final. I'm attending two committee meetings, back to back; one for the ABA and one for the Judicial Conference of the United States.

And those meetings are going to take place next Thursday through Tuesday of the following week. So from Thursday the 12th, for practical purposes, through Wednesday, the 18th, we will not be able to meet in this case.

So when we finish the morning of Wednesday the 11th, we will not resume until the morning of Thursday, the 19th.

I didn't tell you that before now because, as I say, I just wasn't exactly sure what my situation was going to be.

MR. TONE: Did your Honor say we'll finish the morning of Wednesday the 11th?

THE COURT: Right. We will go Wednesday morning the 11th.

MR. TONE: And then adjourn until --

THE COURT: Adjourn until the morning of Thursday the 19th. And then, everything being otherwise propitious, we'll continue through without interruption until we finish the case.

Then I'll see you at 11:00 o'clock tomorrow morning.

MR. KATZ: Thank you, your Honor.

MR. LYNCH: Thank you, your Honor.

MR. GOLDENBERG: Thank you, Judge.

(Whereupon an adjournment was taken herein to 11:00 a.m. of the following day, Thursday, January 5, 1984.)